REMARKS/ARGUMENTS

Preliminarily, Applicant's counsel would like to thank Examiners Graham and Marcheschi for an interview on October 16, 2009. At the interview, Applicant's counsel discussed the differences between improving anti-cavitation and improving lubricity, the fact that anti-cavitation activity reduces evaporization of water in motor vehicle fuels comprising water and liquid hydrocarbon, the fact that Krull's teaching is directed to improving the lubricity affects the hydrocarbon fuels, the fact that Krull's teaches improving the lubricity of hydrocarbon fuels using oil-soluble copolymers, and the fact that Applicant alone recognized the cavitation problems and the anti-cavitation benefits of the co-polymer additives Applicant employed in fuel emulsions. The Examiners maintained that the previously claimed subject matter is not patentable over Westfall (US2002/0116868, published August 29, 2002) in view of Krull (US 6,364,918, issued April 2, 2002) because (1) the copolymer additives taught by Krull for improving hydrocarbon lubricity and the copolymer additives employed by Applicant for preventing cavitation by reducing evaporation of water appear to be similar, and (2) it allegedly would have been prima facie obvious to add Krull's lubricity-improving additives to Westfall's fuel emulsions to improve the lubricity of Westfall's hydrocarbon-containing fuel emulsion. The Examiners explained that the failure of the prior art to recognize the anti-cavitation properties of Krull's copolymers when added to a hydrocarbon fuel would not undermine a conclusion that it would have been prima facie obvious to a person having ordinary skill in the art to add the same copolymer to Westfall's fuel to improve the lubricity of that hydrocarbon-containing fuel. *Compare In re Dillon*, 919 F.2d 688, 693 (Fed. Cir. 1990)("[I]t is not necessary in order to establish a prima facie case of obviousness that . . . there be a suggestion in or expectation from the prior art that the claimed . . . composition will have the same or similar utility . . .").

Claims 1 and 3-24 are pending in the Application. Claims 1 and 10 are currently amended. Claims 3-9 and 11-19 were previously presented. Claims 20-24 are new.

The amendments to Claims 1 and 10 and the quantity of water in the emulsion in new Claims 20 and 24 is supported in the Specification at page 8, lines 17-22. The demineralized or deionized water limitation in new Claims 23-24 is found in the Specification at page 8, lines 22-25. The antifreeze additive and amounts thereof in new Claims 22 and 24 is found in the Specification at page 13, lines 3-12. The mole percent range of carboxylic acid groups in the copolymer in derivative form in new Claims 21 and 24 is supported in the Specification at page 5, lines 20-23.

No new matter is added.

Rejections of Claims 1 and 3-19 under 35 U.S.C. 103 over Westfall in view of Krull

Previously presented Claims 1 and 3-19 were rejected under 35 U.S.C. 103 over Westfall (US 2002/0116868, published August 29, 2002) in view of Krull (U.S. Patent 6,364,918, issued April 2, 2002). Office Action dated August 10, 2009 (OA). In light of the current amendments to the claims, the rejections should be withdraw.

The Examiner's explanation that the failure of the prior art to recognize any anti-cavitation properties of Krull's copolymers when added to a hydrocarbon fuel would not undermine a conclusion that it would have been prima facie obvious to a person having ordinary skill in the art to add the same copolymer to Westfall's fuel to improve the lubricity of that hydrocarbon-containing fuel emulsion is erroneous. Westfall's fuel is a water-in-oil fuel emulsion. Krull's fuel is a middle distillate hydrocarbon fuel. It is not surprising that Krull does not recognize any anti-cavitation benefits associated with its copolymers. Anti-cavitation activity relates to and affects water-in-oil emulsions. Krull's fuels are not water-in-oil emulsions. In fact, any water in Krull's fuels would be present in insignificant or

contaminant amounts and, as such, would not be present in the form of a stable water-in-oil emulsion.

Moreover, it is not apparent from the teachings in Westfall and/or Krull that copolymers which improve the lubricity of Krull's hydrocarbon fuels would also affect the lubricity of a stable water-in-oil fuel emulsions. To the contrary, Applicant's Specification teaches that its anti-cavitation additives, unlike Krull's lubricity additives, interact with the aqueous phase of the water-in-oil fuel emulsions. In addition, Westfall's emulsifiers are designed for maximum solubility in the hydrocarbon phase of its fuel emulsions. It is not at all clear from Krull's disclosure that its lubricity-improving, oil-soluble copolymers would have any stabilizing affect or other positive interaction with Westfall's stable water-in-oil fuel emulsions or have any capacity to improve the lubricity of water-in-oil fuel emulsions the way they allegedly affect Krull's middle distillate hydrocarbon fuels which do not contain water and are not water-in-oil emulsions.

Westfall discloses fuel emulsions comprising stabilized water-in-oil fuel emulsions comprising a hydrocarbon fuel (including diesel fuel), water, and 0.1 to 25% by weight of a "fuel-soluble" or "fuel soluble" emulsifier [0100; 0104; 0126; Claim 1 (i) and (iv)]. Applicant's currently amended claims are directed to a fuel comprising an emulsion between water and a liquid hydrocarbon, and 30 ppm to 3% by weight per total weight of the emulsion of an anti-cavitation copolymer additive, i.e., a copolymer additive which prevents the evaporation of water in a water-in-oil fuel emulsion (Spec., p. 3, l. 16, to p. 4, l. 15). Applicant's anti-cavitation copolymer additives do not appear to affect the stability of the emulsion itself (Spec., p. 5, ll. 2-7), i.e., they are not fuel-soluble emulsifiers of the kind Westfall describes. And, the amount of water in Applicant's emulsion is now required to be 2-40% by weight in currently amended Claim 1 and new Claim 24, 3-20% by weight in currently amended Claim 10, and 4-10% by weight in new Claims 20.

Applicant's anti-cavitation copolymer additives comprise a copolymer prepared by copolymerizing 20-80% in moles of an ethylenically unsaturated carboxylic acid monomer containing at least one carboxylic acid group and 80-20% in moles of at least one other ethylenically unsaturated monomer. Applicant's currently amended Claim 1 requires that (1) at least 20% in moles of the carboxylic acid groups in the copolymer is in the form of at least one derivative selected from the group consisting of carboxylate salt, ester, amide and imide derivative of the carboxylic acid groups, and (2) the copolymer has an average molecular weight Mw ranging from 700 to 3000. New Claims 21 and 24 require that (1) 30-90 mole % of the carboxylic acid groups in the copolymer are in the form of at least one derivative selected from the group consisting of carboxylate salt, ester, amide and imide derivatives of the carboxylic acid groups, and (2) the copolymer has an average molecular weight Mw ranging from 700 to 3000. The molecular weight of Westfall's fuel-soluble emulsifiers is much higher.

Applicant believes that a fair comparison of the composition, properties, and function of the anti-cavitation additives utilized in Applicant's claimed water-in-oil fuel emulsions to the composition, properties, and function of the fuel-soluble, high molecular weight emulsifiers utilized in the aqueous hydrocarbon fuel emulsions Westfall describes shows that Applicant's anti-cavitation additives are not reasonably suggested by Westfall for stabilizing aqueous hydrocarbon fuel emulsions or for any other purpose the art suggests. To the contrary, Westfall teaches away from Applicant's anti-cavitation additives.

Westfall is not at all concerned with the "cavitation" problems associated with fuels comprising water-in-oil emulsions. Rather, Westfall is concerned with producing stable aqueous hydrocarbon fuel emulsions [0002]. Westfall teaches that hydrocarbon fuel emulsions having good stability may be prepared using particular kinds of fuel-soluble emulsifiers.

Applicant's water-in-oil fuel emulsions may also contain emulsion-stabilizing emulsifiers. In fact, some of the emulsifiers Applicant's Specification discloses resemble some of those Westfall describes. See Applicant's Specification at page 9, line 1, to page 12, line 5. However, the molecular weight and function of Applicant's anti-cavitation agents are unrelated to the molecular weight and function of the stabilizing emulsifiers Westfall employs in its fuel emulsions (Spec., p. 12, ll. 6-11).

Westfall's aqueous fuel emulsions may include emulsifiers (i) which are hydrocarbon fuel-soluble products "made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia or an amine" [0109]. However, each hydrocarbyl substituent of said acylating agent is said to have about 50 to about 500 carbon atoms [0109] and a number average molecular weight ranging from 700 to 3000 [0110]. The hydrocarbyl-substituted carboxylic acid acylating agent is made by "reacting one or more alpha-beta olefinically unsaturated carboxylic acid reagents containing 2 to about 20 carbon atoms, exclusive of the carboxyl groups, with one or more olefin polymers" [0111]. The Examiner will recognize that Westfall's emulsifier (i) is a reaction product of a polyolefin having an average molecular weight of 700 to 3,000 and an ethylenically unsaturated carboxylic acid. The resultant polymers have numerous hydrocarbyl sequences, each of which have an average molecular weight of 700 to 3000. Persons having ordinary skill in the art reasonably would have understood that the average molecular weight of the reaction products of an olefin having a hydrocarbyl sequence with an average molecular weight of 700 to 3000 and 20 % to 80 mole % of olefinically unsaturated carboxylic acid monomers must have an average molecular weight which is significantly higher than the 700 to 3000 average molecular weight attributed to one hydrocarbyl substituent itself. Moreover, Westfall's emulsifier (i) with each hydrocarbyl substituent having an average molecular weight very much higher than the 700 to 3000 cannot be prepared by copolymerizing 20-80% in moles of

an ethylenically unsaturated carboxylic acid monomer containing at least one carboxylic acid group and 80-20% in moles of at least one other ethylenically unsaturated monomer and then further reacting at least 20% in moles of the carboxylic acid groups in the prepared copolymer with an amine.

Westfall's emulsifier must include many polyolefin hydrocarbyl substituents having an average molecular weight of 700 to 3000 in order to improve the solubility of the emulsifier in the hydrocarbon fuel phase of its aqueous hydrocarbon fuel emulsion. Westfall's emulsifier does not reduce the surface tension of the aqueous phase of the aqueous hydrocarbon fuel emulsion as does Applicant's lower molecular weight anti-cavitation additives. Westfall's emulsifiers stabilize the aqueous hydrocarbon fuel emulsions. Westfall's emulsifiers are not anti-cavitation additives of the kind Applicant's currently amended claims require.

Westfall also describes an alternative emulsifier (v) which is "the reaction product of A) a polyacidic polymer, B) at least one fuel soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent, and C) a hydroxyl amine and/or a polyamine" [0126]. Examples of Westfall's polyacidic polymers include alpha-olefin/maleic anhydride copolymers [0128], maleic anhydride/styrene copolymers, poly-maleic anhydride, acrylic and methacrylic acid containing polymers, polyacrylates [0129-0132]. A representative example of Westfall's fuel soluble emulsifier (v) is made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent and a hydroxyl amine and/or a polyamine with a polyacidic polymer [0127] and then crosslinking "with an olefin/maleic anhydride copolymer [0133].

While Westfall's emulsifier (v) somewhat resembles the anti-cavitation copolymer additive of Applicant's currently amended Claim 1, Westfall's pre-reacted fuel soluble products are hydrocarbon fuel-soluble products "made by reacting at least one hydrocarbyl-

substituted carboxylic acid acylating agent with ammonia or an amine" [0109]. The hydrocarbyl substituent of the hydrocarbyl-substituted carboxylic acid acylating agent reactant used to prepare Westfall's emulsifier (v) itself has about 50 to about 500 carbon atoms [0109] and a number average molecular weight ranging from 700 to 3000 [0110]. It is that hydrocarbyl-substituted carboxylic acid acylating agent which Westfall reacts with an hydroxyl amine and/or a polyamine [0126] and a polyacidic polymer to prepare its emulsifier (v).

Persons having ordinary skill in the art reasonably would have understood that Westfall's reaction products are formed by reacting an hydrocarbyl-substituted carboxylic acid acylating agent with a hydroxyl amine and/or a polyamine and then reacting the product with every available carboxylic acid group in Westfall's polyacidic polymer coreactant to form emulsifier (v). Thus, every carboxylic acid group in Westfall's polyacidic polymer co-reactant is an ester or an amide of a hydrocarbyl-substituted carboxylic acid acylating agent having a minimum average molecular weight of 700 to 3000. Accordingly, the average molecular weight of Westfall's emulsifier (v) far exceeds the average molecular weight of 700 to 3000 Applicant requires for the anti-cavitation copolymer additive in the fuel emulsion defined by Applicant's current claims.

Westfall's emulsifiers do not eliminate any of the "cavitation" problems the art faced or reduce the surface tension of the aqueous phase of aqueous hydrocarbon fuel emulsions. Westfall's emulsifiers are significantly different from Applicant's anti-cavitation copolymers both in chemical structure and average molecular weight. Westfall's emulsifiers stabilize aqueous hydrocarbon fuel emulsions. Applicant's additives reduce "cavitation" problems associated with aqueous hydrocarbon fuel emulsions without detrimentally effecting the stability of the aqueous hydrocarbon fuel emulsion (Spec., p. 5, ll. 2-7). Persons having ordinary skill in the art reasonably would have understood that the invention defined by

Applicant's currently amended claims is significantly different from the subject matter Westfall discloses.

Nevertheless, the Examiner states (OA, p. 3; emphasis added):

> The claims differ from WESTFALL by adding an anti-cavitation additive to the fuel emulsion comprising a specific copolymer that has an average molecular weight (Mw) ranging from 700 to 3000. However, such copolymers are known in the art as fuel additives as evidenced by KRULL.

First, unlike Applicant's anti-cavitation additive, Westfall's emulsifiers must contain a quantity of hydrocarbon sequences sufficiently large to render the emulsifiers "fuel-soluble" or fuel soluble". Westfall's emulsifiers do not appear to have the capacity to interact with the water phase of the emulsion sufficient to inhibit evaporation of the water in the emulsion as do Applicant's anti-cavitation additives.

On the other hand, Krull teaches hydrocarbon fuel additives having a molecular weight from 700 to 10,000 for use in improving the lubricity of hydrocarbon fuels (Krull, col. 3, ll. 4-14). Krull's additives resemble Applicant's anti-cavitation additives, but Krull's additives are not used to improve the lubricity of stable water-in-oil fuel emulsions and are not otherwise suggested for use in stable water-in-oil fuel emulsions.

Krull teaches, like Westfall, that its additives are "oil-soluble" copolymers (Krull, Claim 1; col. 2, ll. 44-45; col. 4, ll. 18-25). Krull cautions that any functional groups may be included in its additives "so long as they do not impair the oil solubility" (Krull, col. 3, ll. 37-38). Krull is not concerned with water-in-oil fuel emulsions or any kind of interactions between its additives and water. Krull's additives are NOT suggested for use in fuels which contain a substantial amount of water. Krull teaches (Krull, col. 2, ll. 27-30; emphasis added):

> The object of the present invention was to find additives which result in an improvement in lubricity in middle distillates which have been substantially freed from sulfur and aromatic compounds.

Krull's copolymers are useful "for improving the lubricity of middle distillates, and to middle distillate fuel oils containing these additives" (Krull, col 1, ll. 7-14). Krull defines the term "middle distillates" as follows (Krull, col. 8, ll. 31-34):

> The term "middle distillates" denotes, in particular, mineral oils which are obtained by distillation of crude oil and boil in the range from 120 to 450°C., for example kerosene, jet fuel, diesel and heating oil.

Water does not boil in the range from 120 to 450°C.. Accordingly, there is no reason whatsoever for persons having ordinary skill in the art to reasonably suspect that Krull's lubricity improvers would have any beneficial effect on stable water-in-oil fuel emulsions. Tot the contrary, to the extent that Krull's lubricity improvers may not entirely be "oil-soluble" (Krull, ll. 18-25), may have a molecular weight of 700 to 3000, and may include sufficient carboxylate salt, ester, amide, and imide derivatives to promote solubility or interaction with water, persons having ordinary skill in the art would have been led by Westfall's teaching to expect that the copolymers are not "fuel-soluble" or "fuel soluble" as Westfall requires for its emulsifiers, would tend to break rather than improve the stability of its water-in-oil fuel emulsions and would defeat the basic purpose of Westfall's invention.

To sustain a rejection for obviousness under 35 U.S.C. 103, the prior art must reasonably suggest the claimed subject matter with reasonable expectation of success. *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988). The teachings of Westfall and Krull do not suggest the subject matter Applicant claims or provide a reasonable expectation of success. To the contrary, Westfall and Krull appear to teach away from the invention Applicant claims. See *KSR Int'l. Co. v. Teleflex Inc.*, 550 U.S. 398, ___ (2007), for the "principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious."

Moreover, no combination of the teachings of Westfall and Krull would have led persons having ordinary skill in the art to suspect that the use of any of Krull's lubricity

additives would solve any anti-cavitation problems associated with Westfall's water-in-oil fuel emulsions. Neither reference recognized the problem. The results Applicant achieved using its anti-cavitation additives are clearly unexpected.

Westfall teaches away from using Krull's low molecular weight additives in its fuel emulsions. Krull would have taught persons having ordinary skill in the art that its "oil-soluble" additives improve the lubricity of middle distillates which boil between 120 to 450°C. Krull does not mention oil-in-water fuel emulsions. Persons having ordinary skill in the art would have had no motivation or incentive to add Krull's lubricity improvers to Westfall's fuel emulsions and no reason to expect success, especially since Westfall denies the possibility of success using lower molecular weight emulsifiers.

Applicant's invention is remarkable given all the prior art teachings away from the currently claimed invention. Applicant achieved success because Applicant alone recognized the problem and alone decided to tackle the problem using rejected concepts and materials. Applicant achieved success regardless of all the teachings away. Applicant's claims are patentable over the applied prior art.

Finally, new Claims 21-24 recite Applicant's preferred limitations on the amounts and kinds of fuel emulsion components which are not taught or reasonably suggested in either Westfall or Krull, e.g., the presence of carboxylic acid groups 30-90% derivatized by carboxylic salt, ester, amide, and imide groups, the use of demineralized or deionized water in the emulsion, and the further addition of 0.5 to 8% by weight of an antifreeze. No combination of the teachings of Westfall and Krull reasonably would have led persons having ordinary skill in the art to the preferred inventions new Claims 21-24.

Finally, while "it is not necessary in order to establish a prima facie case of obviousness that . . . there be a suggestion in or expectation from the prior art that the claimed . . . composition will have the same or similar utility . . . " (*In re Dillon*, 919 F.2d 688, 693

(Fed. Cir. 1990)), there must be some reasonable suggestion in or expectation from the prior art that the claimed composition to do what Applicant has done with reasonable expectation of success in order to sustain a rejection for obviousness. Here, the combined teachings of Westfall and Krull suggest that Applicant's anti-cavitation additives not only would be useless in stable water-in-oil fuel emulsions but would be detrimental to the desired stability of the water-in-oil fuel emulsions. Applicant's improved fuel emulsion for motor vehicles is patentable over the applied prior art.

For the reason stated, Applicant's current claims are patentable over the applied prior art and in condition for allowance. Early Notice of Allowance is respectfully requested.

Respectfully submitted,

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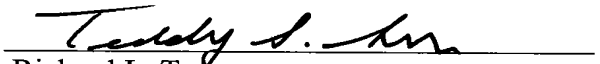

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